THE RADIATION CONFERENCE AT BERLIN AND POTSDAM,[1] FEBRUARY 23-26, 1931

By H. H. KIMBALL

[Weather Bureau, Washington, D. C., April 30, 1931]

Minutes of the first three sessions have been abstracted by H. H. Kimball from a manuscript furnished by A. Ångström, R. Süring, and K. Büttner. Minutes of the last two sessions have been translated by W. W. Reed.

The first session of the conference was held in the meteorological observatory at Potsdam, on February 23. The following were present: A. Ångström, Sweden; W. Mörikofer, Switzerland; F. Albrecht, K. Büttner, P. Dubois, G. Falckenberg, K. Fuessner, H. von Ficker, W. Kühl, F. Linke, W. Marten, and R. Süring, Germany. At later sessions, T. Burgeron, K. Kähler, A. Defant, H. Hergesell, C. Müller, F. Schmidt-Ott, and K. Stuchtey were also present.

Dr. Ångström opened the session with remarks relative to the objects of the conference, and stated the reasons for giving atmospheric turbidity such a prominent place on the program. He then presented Dr. Süring as presiding officer during the session.

Professor Linke found himself in accord with Ångström in questioning Fowle's determinations of the scattering of solar radiation by aqueous vapor in the atmosphere. He held that the vital point of the discussion is whether the amount of turbidity shall appear as a factor ($I=I_oe^{-aTm}$) or as an additive term ($I=I_oe^{-am-\beta m}$). He also pointed out that the turbidity must be capable of easy and accurate determination, and be independent of the air mass.

Ångström considered it advantageous not to include atmospheric absorption in the measurement of turbidity. Also, in agreement with Büttner, the dependence of turbidity upon wave length is recognized. Therefore, he recommends that the definition of turbidity be in such form that the reduction to a known wave length is easily accomplished. The turbidity coefficient, β, fulfills these conditions, and under mean conditions is independent of the wave length. The dependence of the total turbidity extinction on the wave length is expressed by the exponent a in the term $\frac{\beta}{\lambda^a}$.

At the second session of the commission Linke, Dubois, and Fuessner again discussed the dependence of turbidity on the wave length, and Ångström emphasized the fact that by the use of suitable measurements and computations the turbidity factor, the total turbidity extinction, and also the amount of precipitable water above the station can be determined. A discussion on the use of Schott glass filters in actinometric measurements followed.

The third session met at 10:30 a. m. of February 24 in the room of the "Notgemeinshaft der Deutschen Wissenshaft" in Berlin. Professor Süring proposed that the morning session be given up to a discussion of the question "What apparatus or what method should one recommend for the polar year?" Emphasis was laid on the importance of measurements of the intensity of solar radiation with the sun at different heights, using radiation filters controlled by the Potsdam observatory, so as to insure uniformity of results at different stations. Ångström pointed out the importance of reducing the angular opening of the pyrheliometer to about 5°, or at least all observers should give accurate information on the size of the opening of their pyrheliometer. Upsala, Washington, and Potsdam were designated as points at which pyrheliometers might be standardized in known pyrheliometric units.

In the afternoon a new absolute pyrheliometer was inspected at the Physikalisch-Technischen Reichanstalt, at Charlottenburg.

Fourth session, Wednesay, February 25, 10:45 a. m. at the meteorological observatory, Potsdam.

The following subjects were discussed:

1. Discussion of the term air mass. By air mass there can be designated either the true air mass

$$m_b=\frac{b}{760}\cdot \sec. z, \text{ or } \sec. z.$$

In this sec. z is to be taken as the symbol for the Bemporad function. Both measures have their advantages. A decision (between the two definitions) was not reached.

2. After a review of all the σ determinations, the value $\sigma=8.26\cdot 10^{-11}$ was designated as the most probable, since both the most recent measurements as well as the theoretical calculations give this value.

3. Report of Doctor Bergeron, of Oslo, on the eye observations of the opalescent turbidity in the service of synoptics.

The following proposals were formulated for presentation to the international meteorological organization;

1. The measurements of direct solar radiation are to be organized in such manner that in addition to the total depletion of the atmosphere there can be calculated from them the turbidity free from selective absorption by water vapor. To this end it is recommended that all stations employ glass filters of the same composition and thickness. The meteorological observatory, Potsdam, is willing to procure and gage such filters. Special instructions on the nature and use of the filters will be prepared.

2. Since the investigations relative to a decision on a standard scale for pyrheliometric measurements are as yet uncompleted, it is recommended for the present to refer all measurements to the Smithsonian scale of 1913. Readings from instruments standardized in terms of the Ångström scale can be reduced to the Smithsonian scale by the addition of 3.5 per cent.

It is recommended that the standard pyrheliometers to be used during the polar year be compared before and after the expedition at Upsala, Potsdam, or Washington.

In order to eliminate at a later date the falsifying influences of skylight in the measurements of direct solar radiation it is necessary to give, in addition to the type of instrument used, as exactly as possible the aperature conditions of the actinometer (length of tube, size of outer orifice, size of inner orifice, or size of the object-glass surface).

3. It is recommended that at favorably located polar stations, where there is available a sufficiently scientific personnel, there be carried out measurements of total

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[1] To readers not familiar with recent literature on atmospheric turbidity, a brief statement of views held by different investigators may be helpful in interpreting the discussion at the conference.

Linke would include in atmospheric turbidity, T, all atmospheric depletion of solar radiation except that due to molecular scattering, which latter is easily computed from Rayleigh's equations. He represents atmospheric depletion by e^{-a_1Tm}.

Ångström represents atmospheric depletion by $e^{-(a_1+a_2)m}$, in which a_2 is the coefficient of scattering due to causes other than gas molecules, and including that which Fowle found associated with atmospheric water vapor. He expresses a_2 in the form $\frac{\beta}{\lambda^a}$ in which β is the atmospheric turbidity. The term does not include depletion through absorption by atmospheric gases, principally by water vapor. Under average conditions Ångström finds $a=1.3$, which, in contrast with λ^4 in the expression for molecular scattering, indicates that the diameters of the scattering particles are appreciably larger than the diameters of gas molecules.

insolation and of effective outward radiation. The instruments used are to be adjusted to standard apparatus. Suggestions for carrying out such measurements will be specially prepared.

4. Attention is called to the value of measurements of clearness of air, color of sky, anomalous refraction (measurements of the dip of the horizon), twilight, earthlight (Nachtschein), and zodiacal light. Details on the methods of these measurements have been drawn up by Professor Maurer (Zurich) and Dr. F. Schmid (Oberhelfenswil, Switzerland).

5. Special instructions on eye observations of the quantity and character of opalescent turbidity will be drawn up by Doctor Bergeron (Oslo).

6. As the value of the radiation constant there is recommended

$$\sigma = 8.26 \cdot 10^{-11} \cdot \text{cal/cm}^2 \cdot T^4$$
$$(5.76 \cdot 10^{-12} \cdot \text{watt/cm}^2 \cdot T^4).$$

In conclusion Herr Mörikofer reported his experiences in the gaging of cadmium cells and the advantages presented by taking into consideration relations of measurements with and without the employment of Minos glass (as a filter). Later, Herr Kühl presented curves from his new recording filtered potassium cell.

On Thursday, February 26, from 5:30 to 7 p. m. there was discussion of the methods of measurements with the cadmium cell; those taking part were Messrs. Büttner, Dubois, Feussner, Kühl, Mörikofer, and Süring.

(Signed) A. ÅNGSTRÖM.
R. SÜRING.
K. BÜTTNER.

FLYING WEATHER IN THE CORPUS CHRISTI AREA

By J. P. McAuliffe

[Weather Bureau Office, Corpus Christi, Tex.]

The "Corpus Christi area" as usually referred to by aviators in this section extends roughly from Beeville, 56 miles north, to Kingsville, 40 miles south, and George West, 70 miles west. In this small area there is considerable diversity of weather, usually effecting visibility and ceiling.

There are three elements most vitally effecting flying in this area, namely: Fog, wind velocity, and thunderstorms. These three handicaps to flying should be carefully studied by aviators in this area.

Records at the Corpus Christi Weather Bureau show that during the 44-year period, 1887–1930, inclusive, the average number of dense fogs has been as follows during the months indicated:

Month	Number of dense fogs	Month	Number of dense fogs
January	3	October	1
February	2	November	2
March	2	December	3
April	1		

During the other months of the year fog occurs so seldom that it is practically negligible.

A peculiar condition exists at Beeville. Fogs are much more frequent there, and within 5 to 10 miles each side, than they are at Corpus Christi. Many mornings when Corpus Christi and San Antonio report perfect visibility and ceiling, aviators run into dense fog at Beeville. Of course with weather reports from San Antonio and Corpus Christi at hand they fly high and soon come out into clear weather. Occasionally aviators have left Corpus Christi without first getting weather data, and in many of these cases they were forced to turn back when near Beeville, not attempting to fly farther, because they assumed that the fog continued northward.

The cause of these frequent fogs in the vicinity of Beeville seems to be due to the slope of the land eastward to the Gulf, the presence of San Antonio and Copano Bays that indent the coast line sharply in the latitude of Beeville, and probably also the Aransas River that flows past Beeville. These lowlands and water areas here cause air currents from the Gulf to flow westward, meeting the cold interior air, and causing fogs. In thickness and their local character these fogs resemble the mists and fogs of the eastern mountain regions. The frequency of these fogs leaves no doubt that a sharp temperature gradient exists in that locality, especially in the winter months. These fogs are not confined to any particular type of weather, but occur with high pressure, as well as when the barometer is low. They dissipate usually about 10 a. m., but occasionally persist until noon or the midafternoon. The average thickness of these fogs is 1,000 feet.

The second great handicap to safe flying is the wind velocity on this coast.

The writer's attention was first directed to the erratic wind velocities in this section by a letter from one of the officials of the T. A. T. Corporation. In his letter the official mentioned the fact that reports from San Antonio were frequently misleading, because the weather was subject to such erratic changes near Kingsville. He mentioned strong head winds as one of the annoying elements. This would be, of course, a strong southeast or south wind for the planes that were coming from San Antonio. The prevalence of these winds caused a readjustment of schedules by the T. A. T. It was noticed that the planes would enter these windy regions suddenly from a region that had given only moderate southerly breezes, and this windy condition almost invariably occurred within 10 miles of Kingsville. (The planes usually traveled on a course from San Antonio to Brownsville about 50 to 75 miles inland.) This strong wind that the planes encountered at this locality is the celebrated Corpus Christi sea breeze (1) that is always present when some atmospheric disturbance does not interfere with it. It extends for only a short distance inland, and for this reason is encountered only when near the Gulf waters. Kingsville is very close to Baffins Bay, a long narrow bay that extends westward from the Gulf for 30 or 40 miles. The sea breeze on this coast extends to a height exceeding 1,000 feet, and probably as high as as 2,000 feet, as observed by ceiling balloons and the movement of cumulus clouds. The sea breeze in the vicinity of Kingsville has about the same strength as at Corpus Christi and averages 16 to 25 miles per hour. Sometimes it reaches 30 miles per hour.

This annoyance can be avoided, somewhat, by aviators either going far inland and avoiding Kingsville, or swinging Gulfward north of Corpus Christi. The wind velocities are not so great on the Gulf beaches as they are on the shores of the bays. The sea breeze also causes another peculiar atmospheric irregularity, thunderstorms that are difficult to forecast.

From direct observation at Corpus Christi it has been found that thunderstorms occur two or three times more frequently at Robstown, 14 miles westward, than they